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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/730,891

12/10/2003

Ying Zhang

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EXAMINER

MUSTAPHA, ABDULFATTAH B

ART UNIT

PAPER NUMBER

2112

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

01/10/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/730,891	Applicant(s) ZHANG ET AL.	
	Examiner Abdulfattah Mustapha	Art Unit 2112	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>12/10/2003</u> . | 6) <input type="checkbox"/> Other: ____. |

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DETAILED ACTION

Specification

The abstract of the disclosure is objected to because on line 13 symbol 'A' is refer to as 'a'. Correction is required. See MPEP § 608.01(b).

The disclosure is objected to because of the following informalities: 'such as, such as' was mention twice in [0032] line 11.

Appropriate correction is required.

Claim Objections

Claim 2 is objected to because of the following informalities: 'Substitient' in line 9. The word is taking to be 'Substituent' when examine the claim..
Appropriate correction is required.

Claim 12 is objected to because of the following informalities: 'and/or' is not clear. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Ding et al. [5,814,563].

As to claims 1 and 16, Ding et al. disclose the method for making dual pre-doped gate and the resulting gate stack, the method comprising: providing at least one pre-doped conductive layer on a gate stack, wherein said gate stack comprise a substrate and at least one gate dielectric provided on said substrate, (Ding et al.: [Col. 2, Line 31-37]), and etching said at least one conductive layer by exposing it to an etching composition, wherein said etching composition comprises at least one carbon containing gas (Ding et al.: [Col. 2, Line 37-45]).

Claims 13 and 14 are rejected under 35 U.S.C. 102(e) as being anticipated by Ko et al. [US 2005/0035409].

As to claim 13, Ko et al. disclose gate stack having sidewall and width of at least about 3nm. (Ko et al.: [0015], [0016], [0035]).

As to claim 14, Ko et al. disclose conductive material selected from the group consisting of Si, Ge, SiGe, and SiGeC, and mixtures, alloys, or multilayer of the same. (Ko et al.: [0045], [0046]).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-7, and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding et al. [5,814,563] in view of Obeng [6,162,733].

As to claims 2 and 17, Ding et al. disclose carbon containing gas is selected from the group consisting of: (i) gases having the chemical formula C_xH_y , wherein x is an integer ranging from 1 to 10, and Y is an integer ranging from 2 to 22; and (ii) gases having the chemical formula C_xH_yA , wherein x is an integer ranging from 1 to 10, Y is an integer ranging from 0 to 21, and A represents at least one additional substituent selected the group consisting of O, N, S, P, F, Cl, Br, I, and combinations of the same. (Ding et al.: [Col. 2, Line 62-67]), but et al. did not disclose etching composition comprises a halogen-based plasma; and a gas selected from the group consisting of O_2 , N_2 , and mixtures of the same; but Obeng disclose etching composition comprises a halogen-based plasma; and a gas selected from the group consisting of O_2 , N_2 , and mixtures of the same. (Obeng: [Col. 2, Line 57-65]. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding etching composition comprises a halogen-based plasma; and a gas selected from the group consisting of O_2 , N_2 , and mixtures of the same in order to remove contaminants.

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As claims 3 and 18, Ding et al did not specifically disclose halogen based plasma, but disclose etchants selected from the group consisting of CF_4 , CHF_3 , SF_6 , NF_3 , Cl_2 , BCl_3 , HBr , Br_2 , I_2 and mixtures of the same (Ding et al.: [Col2, Line 62-67]); and the carbon containing gas is selected from the group consisting of CH_4 , C_2H_2 , C_2H_4 , C_2H_6 , C_3H_6 , C_3H_8 , C_4H_8 , C_4H_{10} , C_5H_{12} , C_5H_{10} , C_6H_{14} , C_6H_{12} , C_6H_{10} , C_6H_6 , CH_3OH , $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_3\text{H}_7\text{OH}$, CH_3Cl , CH_2Cl_2 , and mixtures of the same. (Ding et al.: [Col. 3, Line 1-4]), but Obeng disclose halogen based plasma (Obeng et al.: [Col. 2, Line 58-59]). It would have been obvious for It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding halogen based plasma in order to etch metal-containing layers to form a patterned metal-containing layer.

As to claims 4 and 5, Ding et al. in view of Obeng shows all the elements except the amount of carbon containing gas in the etching composition ranges from about 0.1% to about 50% by volume of the etching composition, based on the total volume of the etching composition. However the examiner take official notice that the amount of carbon containing gas in etching composition range by volume is notoriously old and well known in the art. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding amount of carbon containing gas in the etching composition in order to provide composition accuracy.

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As to claim 6, Ding et al. disclose conductive material selected from the group consisting of Si, Ge, SiGe, and SiGeC, and mixtures, alloys, or multilayer of the same. (Ding et al.: [Col. 3, Line 49 – 54]).

As to claim 7, Ding et al. disclose conductive layer comprising poly-Si. (Ding et al.: [Col. 3, Line 62-65]).

Claims 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding et al. [5,814,563] in view of Obeng [6,162,733] as applied to claim 1, 2, 3 and 6 above, and further in view of Kito et al. [6,867,450].

As to claim 8, Ding et al. in view of Obeng disclose all the elements of the claim except providing at least one first hardmask layer on said pre-doped conductive layer, wherein said at least one first hardmask layer comprises at least one hardmask material selected from the group consisting of silicon nitride, silicon carbide, silicon hydrogenated carbide, silicon oxidized carbide, and silicon nitridized carbide, and mixtures, alloys, or multilayer of the same; providing at least one second hardmask layer on said at least one first hardmask layer, wherein said at least one second hardmask layer comprises at least one hardmask material selected from the group consisting of silicon oxide, silicon nitride, silicon oxynitride, and silicon carbamide, and mixtures, alloys, or multilayer of the same; (Kito et al.: [Col. 7, Line 46 – 67, to, Col. 8, Line 1 – 9; Col 8, Line 48 – 60; Figure 8A – 34A]), and etching back said at least one first and said at least one second hardmask layers to a width of at least about 3 nm. (Kito

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et al.: [Col. 8, Line 1 – 9; Col. 8, Line 31 – 35]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding above stated element in order to stop/resist etching by carbon fluorine.

As to claim 9, Ding et al. in view of Obeng disclose all the elements of the claim except the first hardmask layer comprises silicon nitride, said second hardmask layer comprises tetraethylorthosilicate (TEOS), and said first and second hardmask layers are etched to a width ranging from about 5 nm to about 150 nm. But Kito et al. disclose first hardmask layer comprises silicon nitride, said second hardmask layer comprises tetraethylorthosilicate (TEOS), and said first and second hardmask layers are etched to a width ranging from about 5 nm to about 150 nm. (Kito et al.: [Col. 7, Line 55 – 67; Col. 8, Line 1 – 9]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding above stated element in order to determine the current drive power.

As to claim 10, Ding et al. in view of Obeng disclose all the elements of the claim except etching back said conductive layer to a width of at least about 3 nm, but Kito et al. disclose etching back said conductive layer to a width of at least about 3 nm. (Kito et al.: [Col. 9, Line 36 – 38]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of

Ding et al. by adding etch back conductive layer to a width of at least about 3nm, in order to be able to bury insulation film.

As to claim 11, Ding et al. in view of Obeng disclose all the elements of the claim except etching back said conductive layer to a width of at least about 3 nm, but Kito et al. disclose etching back said conductive layer to a width of at least about 3 nm. (Kito et al.: [Col. 9, Line 36 – 38]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding etch back conductive layer to a width of at least about 3nm, in order to be able to bury insulation film.

As to claim 12, Ding et al. in view of Obeng disclose all the elements of the claim except conductive material having a thickness ranging from about 10 to about 30nm above said gate dielectric and the method further comprises: exposing the gate dielectric in an over etch (OE) step, wherein said gate is exposed to an OE composition comprising a Br and/or Cl based plasma. However the examiner take official notice that thickness range and Br and Cl based plasma are notoriously old and well known in the art. It would have been obvious to one of ordinary skill in the art to modify the method of Ding et al by adding thickness ranging from about 10 to 30nm above said gate dielectric in order to electrically isolate devices or interconnect lines from the substrate, and by adding OE composition comprising a Br and Cl based plasma in order to reduce the contact resistance and ensure reliable device performance.

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As to claims 19 and 20, Ding et al. in view of Obeng disclose all the elements of the claim except carbon containing gas in the etching composition ranges by volume. However the examiner takes official notice that carbon-containing gas in the etching composition ranges by volume is notoriously old and well known in the art. It would have been obvious to one of ordinary skill in the art to modify the method of Ding et al by adding carbon-containing gas in the etching composition, in order to provide accurate quantity of etching composition.

As to claim 15, Ko et al. disclose all the element except said gate has a width ranging from about 5nm to about 150nm. However the examiner take official notice that the specified width range is notoriously old and well known in the art. It would have been obvious for one of ordinary skill in the art at the time of invention to modify the product of Ko et al. by adding the width range in order to enhance current flow between drain and source.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Abdulfattah Mustapha whose telephone number is 571-272-9736. The examiner can normally be reached on Monday – Thursday 6:30am – 4:00pm, 1st Friday off.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steve McAllister can be reached on 571-272-9818. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Abdulfattah Mustapha



STEVE MCALLISTER
SUPERVISORY PATENT EXAMINER